

LONG-TERM ATMOSPHERIC MERCURY TRENDS IN EASTERN NORTH CAROLINA: RELATIONSHIPS BETWEEN LOCAL SOURCE ACTIVITIES AND AMBIENT AIR MERCURY CONCENTRATIONS

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ABSTRACT

Mercury is a naturally occurring substance that is present at very low levels in ambient air as a result of both natural and anthropogenic processes. In recent years, ultra-sensitive techniques have been developed to measure and speciate mercury in ambient air and rainwater, allowing for the determination of temporal and spatial trends in atmospheric mercury levels. In this paper, we present the results of a multi-year study characterizing trends in ambient air mercury in eastern North Carolina, an area impacted by elevated levels of methylmercury in fish and fish-consuming humans. We present data on total gaseous mercury (TGM) levels in ambient air at several sampling locations, as well as shorter-term measurements of reactive gaseous mercury (RGM) at one location. We also illustrate associations between atmospheric mercury concentrations and wind direction, suggesting local source impacts. Additionally, regional wet deposition data collected in support of the National Atmospheric Deposition Program's Mercury Deposition Network are presented. We submit that historical trends in atmospheric mercury in these areas reflect regional anthropogenic activities involving mercury use.

INTRODUCTION

Concern over mercury emissions originating from a variety of man-made sources has been increasing in the United States due in part to the identification of widespread contamination of fish with methylmercury, a potent neurodevelopmental toxin. While considerable uncertainty remains, it is generally agreed that some fraction of mercury emitted from local or regional sources will enter into nearby aquatic ecosystems through wet and dry deposition mechanisms. Thus, it may be beneficial to identify and reduce airborne emissions near aquatic systems that efficiently move atmospheric inputs of mercury into the aquatic food chain.

The eastern coastal plain of North Carolina is characterized by elevated levels of methylmercury in several species of freshwater fish consumed by recreational and subsistence fishermen. An epidemiological survey conducted in the early 1990s involving area residents identified some of the highest levels of mercury in human hair and blood ever recorded in the U.S. – confirming that both high rates of fish consumption and high levels of methylmercury in fish were contributing to excessive exposures. This focused attention on identifying contributions to the mercury burden in these ecosystems, including atmospheric inputs.